Claims

1. A butt welding apparatus having a pair of two electrode members disposed on both sides, in a thickness direction, of at least one plate member to be welded whose end faces are butted to constitute a butt portion, each electrode member having a thickness size bridging across the butt portion, and the electrode members being provided with pressing portions for pressing one side portion of both side portions of the butt portion of the at least one plate member to be welded in a thickness direction of the at least one plate member to swell and deform an end face of the one side portion which faces the other side portion of the both side portions toward the other side portion by the pressing, for melting and joining the butt portion due to electric resistance heat generated by supplying current between the pair of electrode members, wherein

at least one electrode member of the pair of electrode members is provided on an outer surface thereof which faces the at least one plate member to be welded with a retreating-shaped portion formed so as to gradually retreat from one portion of both portions of the at least one plate member to be welded which are defined through the butt portion according to extension from an intermediate portion, in a thickness direction, of the at least one electrode member of the pair of electrode members along the one portion of the both portions of the at least one plate member to be welded.

2. A butt welding apparatus according to claim 1, wherein

the retreating-shaped portion is provided on the outer face of one electrode member of the pair of electrode members,

the retreating-shaped portion is defined as a first retreating-shaped portion on the one electrode member,

a second retreating-shaped portion formed so as to gradually retreats from the other portion of the both portions of the at least one plate member to be welded according to extension from the intermediate portion, in the thickness direction, of the

one electrode member along the other portion of the at least one plate member to be welded is provided on the outer face of the one electrode member, and

the second retreating-shaped portion and the first retreating-shaped portion are connected to each other.

3. A butt welding apparatus according to claim 1, wherein

the retreating-shaped portion is provided on the outer face of one electrode member of the pair of electrode members,

a projecting continuous portion having a projecting amount equal or approximately equal to the maximum projecting amount of the retreating-shaped portion which projects toward the at least one plate member to be welded is provided on the outer face of the one electrode member, and

the projecting continuous portion connecting to the retreating-shaped portion is constituted such that the equal or approximately equal projecting amount is continuous from the intermediate portion, in the thickness direction, of the one electrode member to extend along the other portion of the at least one plate member to be welded.

4. A butt welding apparatus according to claim 1, wherein the outer face of the other electrode member of the pair of electrode members is formed as a flat shaped portion having an equal or approximately equal projecting amount toward the at least one plate member to be welded which is continuous along a thickness direction of the other electrode member.

5. A butt welding apparatus according to claim 1, wherein the other electrode member of the pair of electrode members is provided on an outer face thereof with a retreating-shaped portion formed so as to gradually retreat from the one portion of the at least one plate member to be welded according to extension from an intermediate portion, in a thickness direction, of the other electrode member along the one portion of the at least one plate member to be welded,

the retreating-shaped portion is defined as a first retreating-shaped portion on the other electrode member,

a second retreating-shaped portion formed so as to gradually retreat from the other portion of the at least one plate member to be welded according to extension from the intermediate portion, in the thickness direction, of the other electrode member along the other portion of the at least one plate member to be welded is provided on the outer face of the other electrode member, and

the second retreating-shaped portion and the first retreating-shaped portion are connected to each other.

6. A butt welding apparatus according to claim 1, wherein the other electrode member of the pair of electrode members is provided on an outer face thereof with a retreating-shaped portion formed so as to gradually retreat from the one portion of the at least one plate member to be welded in accordance with extension from an intermediate portion, in a thickness direction, of the other electrode member along the one portion of the at least one plate member to be welded and a projecting continuous portion having a projecting amount equal to or approximately equal to the maximum projecting amount of the retreating-shaped portion which projects toward the at least one plate member to be welded, and

the projecting continuous portion connecting to the retreating-shaped portion is constituted such that the equal or approximately equal projecting amount is continuous from the intermediate portion, in the thickness direction, of the other electrode member to extend along the other portion of the at least one plate member to be welded.

7. A butt welding apparatus according to claim 1, wherein the pair of electrode members are electrode rollers which roll relative to the at least one plate member to be welded.

8. A butt welding apparatus according to claim 1, wherein the pair of electrode

members have length sizes extending along the butt portion of the at least one plate member to be welded, and are constituted as block electrodes for acting a press load on the at least one plate member to be welded.

9. A butt welding apparatus according to claim 8, wherein the butt portion of the at least one plate member to be welded extends linearly and the pair of block electrodes have linearly extending shapes corresponding to the butt portion.

10. A butt welding apparatus according to claim 8, wherein the butt portion of the at least one plate member to be welded extends non-linearly and the pair of block electrodes have non-linearly extending shapes corresponding to the butt portion.

11. A butt welding apparatus according to claim 8, wherein the pair of block electrodes have shapes corresponding to a shape of the at least one plate member to be welded which has been press-formed, and butt welding of the at least one plate member to be welded which has been press-formed is conducted by the pair of block electrodes.

12. A butt welding apparatus according to claim 8, wherein the pair of block electrodes are arranged in respective press dies for press-forming the at least one plate member to be welded, and when the at least one plate member to be welded is press-formed in the press dies, butt welding of the at least one plate member to be welded is conducted by the pair of block electrodes.

13. A butt welding apparatus according to claim 12, wherein the pair of block electrodes are assembled in the respective press dies via electrically insulating members.

14. A butt welding apparatus according to claim 1, wherein the pair of electrode members are a pair of spot electrodes for spot-welding the at least one plate member to be welded.

15. A butt welding apparatus according to claim 14, wherein the pair of spot electrodes are for butt-welding the at least one plate member to be welded which has been subjected to a press forming.

16. A butt welding apparatus according to claim 14, wherein the pair of spot electrodes are arranged in respective press dies for press-forming the at least one plate member to be welded, and when the plate member to be welded is press-formed by the press dies, the butt welding of the plate member to be welded is conducted by the pair of spot electrodes.

17. A butt welding apparatus according to claim 16, wherein the pair of spot electrodes are assembled in the respective press dies via electrically insulating members.

18. A butt welding apparatus according to claim 1, wherein the at least one plate member to be welded comprises two plate members to be welded, and the butt portion is formed by butting respective end faces of the two plate members to be welded to each other.

19. A butt welding apparatus according to claim 1, wherein the at least one plate member to be welded comprises one plate member to be welded, and the butt portion is formed by butting two end faces of the one plate member to be welded which has been formed in a pipe shape to each other.

20. A butt welding apparatus according to claim 19, wherein the one plate member to be welded which has been formed in a pipe shape is formed by joining a plurality of plate members.

21. A butt welding method where one electrode member of a pair of two electrode members which are disposed on both sides, in a thickness direction, of at least one plate member to be welded, end faces of the at least one plate member to be welded being butted to each other to constitute a butt portion and each electrode member having a thickness size bridging across the butt portion, is provided on an outer face of the one electrode member with a retreating-shaped portion which gradually retreats from one side portion of both side portions of the butt portion of the at least one plate member to be welded according to extension from an intermediate portion, in a thickness direction,

of the one electrode member along the one side portion of the both side portions of the butt portion of the at least one plate member to be welded, and the butt portion is butt-welded by the pair of electrode members, comprising:

a working step of setting the position of the butt portion relative to the pair of electrode members as a position having an offset amount corresponding to thickness sizes of the both side portions of the butt portion of the at least one plate member to be welded from the intermediate portion, in the thickness direction, of the one electrode member toward the retreating-shaped portion; and

another working step of pressing, in a thickness direction of the at least one plate material to be welded, one portion of both portions of the at least one plate member to be welded which are defined through the butt portion on the plate member to be welded by the pair of electrode members being supplied with power to swell and deform an end face of the one portion which faces the other portion of the both portions toward the other portion, thereby melting and joining the butt portion with electric resistance heat.

22. A butt welding method according to claim 21, wherein the pair of electrode members are arranged in respective press dies for press-forming the at least one plate member to be welded, and when the at least one plate member to be welded is press-formed by the press dies, the butt welding of the butt portion is conducted by the pair of electrode members.